

WE CLAIM:

1. An apparatus for balancing a shaft of an aircraft engine comprising:

a plate defining a first group of holes axially extending therethrough, the round plate being co-axially attached to the shaft at a forward end thereof; and

at least one standard fastener for selectively engaging at least one of the holes in the first group to thereby add a balancing weight to the plate.
2. An apparatus as claimed in claim 1 wherein the plate further comprises a mounting system for mounting a nose cone thereto.
3. An apparatus as claimed in claim 2 wherein the mounting system comprises a second group of holes axially extending through the plate for receiving mounting bolts therein.
4. An apparatus as claimed in claim 1 wherein the plate comprises a position element on a forward surface thereof for co-axially aligning the nose cone with the shaft.
5. An apparatus as claimed in claim 1 wherein the plate comprises a position element on a rear surface thereof for co-axially aligning the plate with the shaft.

6. An apparatus as claimed in claim 3 wherein the plate comprises a plurality of clinch nuts attached to the respective holes of the second group on a rear surface of the plate for engaging the respective mounting bolts.
7. An apparatus as claimed in claim 6 wherein the plate comprises means on the rear surface thereof for restraining rotation of the respective clinch nuts.
8. An apparatus as claimed in claim 1 the wherein the standard specification-sized fasteners comprise a variety of standard screws having identical diameters but different lengths such that one of the screws with a selected length can be engaged in the at least one of the holes of the first group as the selected balance weight added to the plate.
9. An apparatus as claimed in claim 5 wherein the plate comprises a central aperture for receiving the shaft extending therethrough with clearance therebetween, the plate being affixed to the shaft by a fan retaining nut secured to the forward end of the shaft, the plate being axially restrained between the fan retaining nut and a radial wall of a fan rotor of the aircraft engine, and the position element on the rear surface of the plate for co-axially aligning the plate with the shaft contacting an axial surface of the fan rotor.
10. An apparatus for an aircraft engine comprising:
a nose cone of the aircraft engine;
at least one balance weight element;

a member centrally mounted to a forward end of a rotatable shaft of the aircraft engine, the member including a mounting apparatus by which the nose cone is mounted to the member, and the member adapted to cooperate with the at least one balance weight element to retain the weight element to the member to rotationally balance the shaft.

11. An apparatus as claimed in claim 10 wherein the member includes a plurality of attachment points
12. An apparatus as claimed in claim 11 wherein the respective at least one weight element and the attachment points are configured to permit the at least one weight element to be retained to the member from a forward side of the member.
13. An apparatus as claimed in claim 11 wherein the respective nose cone and the mounting points are configured to permit the nose cone to be mounted to the member from a forward side of the member and cover the at least balance weight element.
14. An apparatus as claimed in claim 11 wherein the member comprises a first positioning element thereof to align the member with the shaft for the central mounting of the member to the shaft.
15. An apparatus as claimed in claim 11 wherein the member comprises a second positioning element thereof to co-axially align the nose cone with the member.

16. A method of balancing a shaft of an aircraft engine, the shaft including a mounting plate for mounting a nose cone to one side thereof, the method comprising steps of:

with the nose cone unmounted, observing a rotational imbalance of the shaft; and

accessing the mounting plate through a front opening of a casing of the aircraft engine to install and affix at least one standard fastener in one of a plurality of axial holes of the mounting plate determined during the observation step to thereby rotationally balance the shaft.
17. A method as claimed in claim 16 comprising a step of selecting the at least one standard fastener from a plurality of standard fasteners having identical diameters and different lengths to provide a selected balance weight added to the plate.
18. A method as claimed in claim 17 further comprising a step of applying adhesive between the selected at least one standard fastener and the hole in the determined at least one position on the mounting plate for additional retention to the fastener in the hole.
19. A method as claimed in claim 17 further comprising a step of mounting the nose cone to the mounting plate after the shaft is rotationally balanced, a wall of the nose cone providing additional retention to the fastener received in the hole.